

WHAT IS CLAIMED IS:

1. A magnetic cell comprising:

a first ferromagnetic layer whose magnetization is substantially fixed in a first direction;

a second ferromagnetic layer whose magnetization is substantially fixed in a second direction opposite to the first direction;

a third ferromagnetic layer provided between the first and the second ferromagnetic layers, a direction of magnetization of the third ferromagnetic layer being variable;

a first intermediate layer provided between the first and the third ferromagnetic layers; and

a second intermediate layer provided between the second and the third ferromagnetic layers,

the direction of magnetization of the third ferromagnetic layer being determined under an influence of spin-polarized electrons upon the third ferromagnetic layer by passing a current between the first and the second ferromagnetic layers.

2. The magnetic cell according to claim 1, wherein an easy axis of magnetization of the third ferromagnetic layer is substantially in parallel to the first direction.

3. The magnetic cell according to claim 1, wherein an electric resistance between the first and the third ferromagnetic layers takes a first value when the direction of magnetization of the third layer is substantially same as the first direction, the electric resistance between the first and the third ferromagnetic layers takes a second value larger than the first value when the direction of magnetization of the third layer is substantially same as the second direction,

an electric resistance between the second and the third ferromagnetic layers takes a third value when the direction of magnetization of the third layer is substantially same as the second direction, and the electric resistance between the second and the third ferromagnetic layers takes a fourth value larger than the third value when the direction of magnetization of the third layer is substantially same as the first direction.

4. The magnetic cell according to claim 1, wherein the direction of magnetization of the third ferromagnetic layer is determined to be the first direction when an electric current is passed from the first ferromagnetic layer to the second ferromagnetic layer via the third ferromagnetic layer, and

the direction of magnetization of the third

ferromagnetic layer is determined to be the second direction when an electric current is passed from the second ferromagnetic layer to the first ferromagnetic layer via the third ferromagnetic layer.

5. The magnetic cell according to claim 1, wherein an electric resistance between the first and the third ferromagnetic layers takes a first value when the direction of magnetization of the third layer is substantially same as the first direction, the electric resistance between the first and the third ferromagnetic layers takes a second value smaller than the first value when the direction of magnetization of the third layer is substantially same as the second direction,

an electric resistance between the second and the third ferromagnetic layers takes a third value when the direction of magnetization of the third layer is substantially same as the second direction, and the electric resistance between the second and the third ferromagnetic layers takes a fourth value smaller than the third value when the direction of magnetization of the third layer is substantially same as the first direction.

6. The magnetic cell according to claim 1, wherein an electric resistance of the first intermediate

layer and an electric resistance of the second intermediate layer are different.

7. The magnetic cell according to claim 1, wherein one of the first and the second intermediate layers is made of an insulating material having a pinhole, and the pinhole is filled by at least one of materials of the adjoining ferromagnetic layers.

8. The magnetic cell according to claim 1, wherein the magnetization of at least one of the first and the second ferromagnetic layers is fixed by an adjoining antiferromagnetic layer.

9. The magnetic cell according to claim 1, wherein a nonmagnetic layer, a fourth ferromagnetic layer and an antiferromagnetic layer are laminated in this order to adjoin at least one of the first and the second ferromagnetic layers, and magnetizations of the ferromagnetic layers adjoining both sides of the nonmagnetic layer are fixed in a same direction.

10. The magnetic cell according to claim 1, wherein a nonmagnetic layer, a fourth ferromagnetic layer and an antiferromagnetic layer are laminated in this order to adjoin at least one of the first and the

second ferromagnetic layers, and magnetizations of the ferromagnetic layers adjoining both sides of the nonmagnetic layer are fixed in mutually opposite directions.

11. The magnetic cell according to claim 1, wherein the third ferromagnetic layer has a laminated structure where a plurality of layers made of a ferromagnetic material are laminated.

12. The magnetic cell according to claim 1, wherein one of the first and the second intermediate layers is made of a conductive material and other of the first and the second intermediate layers is made of an insulating material.

13. A magnetic cell comprising:

a first magnetically fixed part including a first ferromagnetic layer whose magnetization is substantially fixed in a first direction;

a second magnetically fixed part including a second ferromagnetic layer whose magnetization is substantially fixed in a second direction opposite to the first direction;

a third ferromagnetic layer provided between the first and the second magnetically fixed part, a

direction of magnetization of the third ferromagnetic layer being variable;

a first intermediate layer provided between the first magnetically fixed part and the third ferromagnetic layer; and

a second intermediate layer provided between the second magnetically fixed part and the third ferromagnetic layer,

an easy axis of magnetization of the third ferromagnetic layer being substantially in parallel to the first direction,

at least one of the first and the second magnetically fixed parts including a laminated structure where ferromagnetic layers and at least one nonmagnetic layer are laminated in turn and the ferromagnetic layers are antiferromagnetically coupled via the nonmagnetic layer,

the first ferromagnetic layer adjoining the first intermediate layer,

the second ferromagnetic layer adjoining the second intermediate layer, and

the direction of magnetization of the third ferromagnetic layer being determined under an influence of spin-polarized electrons upon the third ferromagnetic layer by passing a current between the first and the second magnetically fixed parts.

14. The magnetic cell according to claim 13, wherein a number of the ferromagnetic layers of one of the first and the second magnetically fixed parts is even, and a number of the ferromagnetic layers of other of the first and the second magnetically fixed parts is odd.

15. The magnetic cell according to claim 14, further comprising a substrate on which the first and the second magnetically fixed parts, the third ferromagnetic layer, and the first and the second intermediate layers are laminated,

a number of the ferromagnetic layers of one of the first and the second magnetically fixed parts which is provided remoter from the substrate than other of the first and the second magnetically fixed parts is even.

16. The magnetic cell according to claim 13, wherein the third ferromagnetic layer has a laminated structure where a plurality of layers made of a ferromagnetic material are laminated.

17. The magnetic cell according to claim 13, wherein one of the first and the second intermediate layers is made of a conductive material and other of

the first and the second intermediate layers is made of an insulating material.

18. A magnetic memory comprising a memory cell where a plurality of magnetic cells are arranged in a matrix fashion, each of the magnetic cells being separated by an insulator from other memory cells,

each of the magnetic cells having:

a first ferromagnetic layer whose magnetization is substantially fixed in a first direction;

a second ferromagnetic layer whose magnetization is substantially fixed in a second direction opposite to the first direction;

a third ferromagnetic layer provided between the first and the second ferromagnetic layers, a direction of magnetization of the third ferromagnetic layer being variable;

a first intermediate layer provided between the first and the third ferromagnetic layers; and

a second intermediate layer provided between the second and the third ferromagnetic layers,

the direction of magnetization of the third ferromagnetic layer being determined under an influence of spin-polarized electrons upon the third ferromagnetic layer by passing a current between the first and the



second ferromagnetic layers.

19. The magnetic memory according to claim 18, further comprising a probe to get access to each of the magnetic cells of the memory cell.

20. The magnetic memory according to claim 18, wherein one of word lines and one of bit lines are connected to each of the magnetic cells of the memory cell, and recording or reproduction with a specific magnetic cell is made possible by selecting one of the word lines and one of the bit lines.

21. A magnetic memory comprising a memory cell where a plurality of magnetic cells are arranged in a matrix fashion, each of the magnetic cells being separated by an insulator from other memory cells,

each of the magnetic cells having:

a first magnetically fixed part including a first ferromagnetic layer whose magnetization is substantially fixed in a first direction;

a second magnetically fixed part including a second ferromagnetic layer whose magnetization is substantially fixed in a second direction opposite to the first direction;

a third ferromagnetic layer provided between

the first and the second magnetically fixed part, a direction of magnetization of the third ferromagnetic layer being variable;

a first intermediate layer provided between the first magnetically fixed part and the third ferromagnetic layer; and

a second intermediate layer provided between the second magnetically fixed part and the third ferromagnetic layer,

an easy axis of magnetization of the third ferromagnetic layer being substantially in parallel to the first direction,

at least one of the first and the second magnetically fixed parts including a laminated structure where ferromagnetic layers and at least one nonmagnetic layer are laminated in turn and the ferromagnetic layers are antiferromagnetically coupled via the nonmagnetic layer,

the first ferromagnetic layer adjoining the first intermediate layer,

the second ferromagnetic layer adjoining the second intermediate layer, and

the direction of magnetization of the third ferromagnetic layer being determined under an influence of spin-polarized electrons upon the third ferromagnetic layer by passing a current between the first and the

second magnetically fixed parts.

22. The magnetic memory according to claim 21, further comprising a probe to get access to each of the magnetic cells of the memory cell.

23. The magnetic memory according to claim 21, wherein one of word lines and one of bit lines are connected to each of the magnetic cells of the memory cell, and recording or reproduction with a specific magnetic cell is made possible by selecting one of the word lines and one of the bit lines.